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EDITORIAL.

THE present number of the Malayan Agricultural Journal is devoted to the consideration of the various aspects of kapok production in Malaya. The conclusion is that this crop might with advantage be produced locally under plantation conditions. Kapok plantations already exist in the Philippane Islands, in Siam and Java, but as far as can be ascertained, no estate has published its results, possibly because they are as yet inconclusive. or because they prefer to keep them as "trade secrets".

Kapok production, and in particular, the uses to which the floss may be put, has attracted considerable attention during the last few years, owing largely to the extended use of kapok during the war for filling life belts, ocean jackets etc. There are indications that a gradual increase in kapok would easily be absorbed in the world's market. Recent advice from America is to the effect that manufacturers of mattresses are unable to boom kapok as a filler owing to the difficulty of obtaining supplies. On the other hand, a London broker states that the market there would be adversely influenced by an additional shipment of a thousand tons or so. The Department of Agriculture is in a position to place producers of kapok in direct touch with firms anxious to buy. The latter are of opinion that there is no likelihood of over-production for many years to come.

A recent article in this Journal pointed out the difficulty experienced in the West Indies where considerable damage was occasioned to the cotton crop by reason of the pests of cotton finding a host between the seasons on kapok. Owing to the impossibility of inducing the owners of the kapok trees to harvest their crops it was found necessary to destroy all the kapok trees in cotton growing areas. There is no reason why kapok should be a danger to cotton in this respect if the owners of the kapok trees harvest their crops at the proper time. Malaya is not a cotton growing country. but the possibility must be kept in mind that the day may come when the harvesting of cotton and kapok will have to be controlled, in order that one crop may not prove a host for the pests of the other crop.

The account of kapok given in this Journal is a result of close observation of the trees existing in Malaya, and a comparison of the conditions obtaining here and in other kapok producing countries. The thanks of the Department are due to the authors of numerous books of reference on Kapok, to the Governments of other countries who have placed at our disposal information on the crop; and to the Agent, Malay States Information Agency for making enquiry regarding the position in England; and also to a large number of firms and individuals in various parts of the world who have assisted with information, advice and encouragement.

Finally, we cannot refrain from pointing out one of the greatest advantages of kapok cultivation of the fact that the area under the crop can be used for the cultivation——crops in conjunction with the main crop, by reason of the sparse shade thrown by kapok. And we would lay down our definite recommendation that Malaya is suitable for the profitable production of kapok under plantation conditions.

KAPOK.

By D. H. Grist.

Botanical.*

KAPOK (*Eriodendron anfractuosum* D. C., Syn. *Caiba pentandra* Gartu., *E. pentandrum*, Kurz, var. *Indicum* D. C.) belongs to the family of the *Bombaceae*. It is a tall tree, its columnar stem bearing a sparse top of almost bare branches, extending horizontally, arranged in whorls of three branches each. In young specimens the stems bear short sharp spines, which break off on the older trees. Spininess however, varies in different trees here, and in some cases persists regardless of age. The flowers are borne in groups of two to eight in the axils of the leaves. The flowers, which are stalked, have a green calyx with five short sepals. The corolla protrudes from the calyx and is conspicuous on account of its dimensions and its colour. The corolla is of a dirty white colour, and consists of five almost free petals, 3-4 centimetres long and 12-14 millimetr es broad. The torus is very short, and carries five long stamens which protrude prominently from the corolla. The gynoecium is five-segmented, the septa not extending quite to the top ; the style is 2.5-3.5 cms. long and has a slightly lobed stigma.

The fruit is a long capsule resembling a cucumber (7.5-14 cms. long), the five segments splitting longitudinally and displaying a woolly mass, the true kapok floss, in which the seeds lie completely free. The floss is attached to the wall of the fruit, and consists, according to Greshoff, of elongated endocarp cells. The seeds are numerous, dark brown, bare and pearshaped.

Little can be said of the varieties of kapok ; a systematic research has not yet been undertaken. That a scientific study of the subject is full of promise is indicated by a note of Bley's on "randoe lanang", a form in which the lower branches do not drop off. With an eye to the incidental profit on the harvest, Bley has sown the seed of this form and obtained descendants which, for the most part, appear to possess the desired characteristics.

Uses.

Kapok is used very extensively as a "filler" for mattresses, pillows and other articles of upholstery ; and on account of its buoyancy and non-matting qualities, it is superior to almost any other filler. Its advantages as a filler are pointed out by Mathieu in the following table, giving the comparative weights and costs of various fillers necessary to stuff one average mattress :—

Kapok.	9	kilos @ 3.50 francs per kilo	=	31.50 francs.
Seaweed.	16	„ @ 0.75 „ „ „	=	12.00 „
Wool (white carded)	10	„ @ 3.15 „ „ „	=	31.50 „
Horse hair and wool.	5½	„ @ 5.15 „ „ „	=	43.07 „
	5½	„ @ 3.15 „ „ „		

* The botanical account given in this place is a free translation from Van Gorkom's Oost-Indische Cultures.

It is seen that kapok more than holds its own in competition with animal fibres, but is more expensive than vegetable fibres. The quality of kapok however is far superior to other vegetable fibres. Kapok which has become hard with much use rapidly regains its excellent qualities when exposed to bright sunlight. It has found extended uses during recent years in life-saving apparatus, buoyancy cushions and ocean jackets. The market for kapok is also likely to expand when its value is better appreciated as a filler for surgical dressings. For this purpose it is said to possess the requisite advantages of lightness, elasticity, dryness and suitability for dry sterilation.

Kapok is very largly used in making "down" quilts. The cost of "eider down" quilts is very considerable, but kapok down is said to be quite as good, being as light and warmer than eider, and of course is very much cheaper.

Comparative Buoyancy values of Malayan and Java Kapok.[1]

Since kapok is used extensively in life saving apparatus—life belts, life jackets etc., for which standards of buoyancy have been fixed in different countries, it was considered desirable to ascertain the value of Malayan Kapok compared with Java Kapok, (the latter being well known on the market and considered a standard product) in respect of its buoyancy.

British Standard for Kapok:—The following are the standards laid down by the Board of Trade (Marine Circular No. 1572 Instructions to Surveyors, Life Jackets April 1916).

(*a*) Life jackets intended for use by adults must be capable of supporting at least 15 lbs. of iron in fresh water for at least 24 hours.[2]

(*b*) At least 24 ozs. of Kapok must be in life belts which derive their buoyancy from that material.

(*c*) The material to be used for the cover must be unglazed unmangled and free from dressing.

A life jacket whose buoyancy is derived from Kapok must be capable of supporting at least 20 lbs. of iron after floating in water for 24 hours with a 15 lb. iron weight attached.

Description of Samples examined:—Two samples of Malayan kapok were received and investigated, one from the Krian district and one from the Lower Perak district. Both samples contained seed and a certain amount of pod which were separated by hand. The fibres were more curled than the Java fibre but the colour and length of ultimate fibre were similar.

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1 Contributed from the investigations of the Agricultural Chemist, Department of Agriculture F.M.S. and S.S.

2 Regulation (*a*) has been amended by circular No. 1585, (Board of Trade, Marine) to read as follows.

Results of Examination :—A proximate analysis of the samples is given in the table below which includes also samples of Java and Indian Kapok examined at the Imperial Institute :—

	Krian sample.	Lower Perak samples.	Java sample.	Java sample examined at Imperial Institute.	Indian sample examined at Imperial Institute.
	p. cent.	p. cent.	p. cent.	per cent.	per cent.
Moisture (unwasheds sample).	9.5	8.23	6.9	9.0	8.1
Ash (dry unwashed sample).	1.57	1.09	1.16	1.3	4.4
Ash (dry washed sample).	0.46	0.50	0.92	1.0	2.7

The figures in the above table show that the Malayan samples are very similar to the Java sample in respect of ash and moisture.

Volume Measurements :—A determination of the relative volumes occupied by equal weights of the Malayan and Java Kapok gave the following results :—

Java Kapok	100
Krian Kapok	86
Lower Perak Kapok ...	85.5

The above results indicate that the Java sample would probably prove rather superior in buoyancy to the Malayan samples, which was confirmed by the buoyancy tests.

Buoyancy Tests.—The following table shows the results obtained by buoyancy tests :—

Sample.	Sinking force in ozs. (A) On first immersion.	Sinking force in ozs. (B) After 24 hours with 3 lbs. weight attached.	Sinking force in ozs. (C) Weight of water absorbed after Test B.	Remarks.
Java ...	108.4	110	2.2	Mean of tests on rigid and non-rigid cushions.
Krian ...	99	103.5	1.8	
L. Perak ...	104.7	103.5	2.0	
Java ...	70.8	68.0	...	Tests made on approximately spherical cushions with compressed kapok.
Krian ...	65	66.0	3.5	
L. Perak ...	65	67	3.0	

The above table shows the results obtained on three types of cushions, flat rigid, flat non-rigid and spherical.

A "rigid" cushion consisted of a cushion on which a flat weight was placed so that the shape of the cushion was not materially affected.

In the case of the "non-rigid" cushion the weights were concentrated on the centre of the cushion, thus affecting its shape.

The results obtained for the rigid cushions were slightly superior in all cases to those obtained for the non-rigid cushions.

In the case of the spherical cushions, the same weight of kapok was compressed into a spherical cushion of about one half the size of the other cushions. The results on this type of cushion are inferior to those obtained on the flat cushions, but are still above the board of Trade Standard.

The results given are the mean of three successive sinkings, since it was found that each sinking did not give identical results. The covers of the cushions were made of coarse undressed butter muslin of about 4,600 meshes per sq. inch. The flat cushions, containing 4 oz of kapok, measured $9\frac{5}{8}$ ins. $\times$ $13\frac{1}{4}$ superficially.

From the above results on 4 oz. cushions, the following sinking forces are calculated for 24 oz. cushions. (After 24 hours with 15 lbs. of iron attached).

	Flat Cushions.	Spherical Cushions.
Java Kapok ...	41.2 lbs.	25.6 lbs.
Krian Kapok ...	38.8 „	25.0 „
Lower Perak Kapok ...	38.8 „	25.1 „

The above results were confirmed by a few direct tests on flat rigid 24 oz. cushions, the following results being obtained :—

Sample.	Weight required to sink Cushions immediately.	Weight required after 24 hours with 15 lbs. of iron attached.
	lbs.	lbs.
Java ...	40.4	41.0
Krian ...	37.2	38.2
Lower Perak	37.1	38.0

As will be seen, the above results obtained by direct tests are in close agreement with the calculated results.

Summary.——The results of this investigation show that the Malayan samples are only slightly inferior to the Java samples and are well above the Board of Trade Standard.

The results obtained under different conditions of testing indicate also the desirability, in connection with the standards adopted, of laying down a few details in respect of the conditions under which the tests should be carried out.

Much has been heard from time to time regarding the suitability of kapok for spinning purposes. In 1911 the Germans claimed to have found a method of spinning, but on further tests concluded that it was not a commercial success. More recently, the "Manchester Guardian" pointed out its value in this respect and reported that remarkable yarns and clothes have been produced from kapok at the Agricultural School, Hanoi-Cochin China. Enquiry of the Director of Economic Services, Indo-China elicited the information that kapok had indeed been spun and woven in Indo-China by the natives on hand looms, and samples of the finished cloth, in both blue and red were sent. The kapok has taken the colour fairly well. The cloth is of a thick nature, coarse and not strong. The industry has now died out as no market could be found for the cloth. It seems to the present writer that the fabric is quite unsuited for making garments, but might be of considerable value for the linings of overcoats. Such coats would be very warm, light and practically waterproof.

By-Products.

The kapok tree has been put to various uses in Java. The growing trees are there largely employed as telegraph and telephone poles, and to form boundary fences between properties. The leaves are said to be employed in Java as medicine for stomach troubles. The placentas are generally thrown away but may have a use for stuffing mattresses. It is probably suitable for paper making but unlikely to be available in sufficient supplies.

The report has been current of late that the wood from the Kapok tree is largely used in Ceylon and Malaya for match making. This may possibly be true of Ceylon, but certainly not of Malaya.

Kapok seed is a valuable by product of the industry. The export of seed from Java in 1911 stated in pikuls was as follows:— to England 130,000, France 18,000, Holland 15,000.

(1) "Out of 11,042 tons of Kapok oil exported during the first eight months of the current year (2), 9,880 tons came to Great Britain, 879 tons going to France, 281 tons to Holland, and 2 tons to Singapore. In 1920, of the total 12.575 tons exported, 10,886 tons were sent to Great Britain, and in 1921, 1,146 tons of the 1,151 tons exported were imported by the United Kingdom."

The kapok seed cake resulting from the expression of the oil is a valuable cattle food.

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(1) Netherlands Indies Review Vol. 3 No. 7.

(2) 1922.

Kapok Oil.*

Oil Content.

Local kapok seed contains between 19 and 20 per cent of oil, as the following table giving the results of analyses of seed from different parts of the country shows:

	Kuala Kangsar.	Lower Perak.	Krian.
	per cent.	per cent.	per cent.
Moisture ...	9.6	13.5	13.3
Oil ...	22.1	18.6	16.8
Residue (By difference) ...	68.3	67.9	69.9
Nitrogen ...	3.33	3.44	3.28
Oil (Calculated on dry seed) ...	24.4	21.5	19.4
Nitrogen (Calculated on dry oil-free residue) ...	4.88	5.07	4.70

It will be noticed also that the dry residue remaining after the oil extraction is rich in nitrogen, the average of the three determinations being approximately 4.9 per cent, corresponding to 30.6 per cent of albumenoids.

Expression of Oil.

Experiments carried out using a small laboratory hand-press have shown that the oil is easy to express, and that it requires no subsequent treatment beyond filtering before placing on the market. Thus, a sample of the cake remaining from some of the Kuala Kangsar seed which had been warm-pressed twice had an oil content of only 9.0 per cent. Assuming that the original seed had an oil content of 22 per cent (compare table above) it will be seen that about 60 per cent of the oil has been expressed.

The expressed oil was clear, yellow in colour and had a sweetish smell. A certain amount of "stearin" deposited on standing, but this is a feature of the oil.

Characteristics of Oil.

The following table gives the physical and chemical characteristics of kapok oil, expressed from Kuala Kangsar seed, together with those for cottonseed oil to which this oil is closely related.

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* Contributed from the investigations of the Agricultural Chemist, Department of Agriculture F.M.S. & S.S.

	Kuala Kangsar Kapok oil.	Average figures for Cottonseed oil.
Oil.		
Density (15.5°C) ...	.918	.923
Refractive index (20°C) ...	1.4710	—
Saponification value ...	191.0	193
Iodine value (Wijs) ...	94.3	110
Acidity (Oleic Acid per cent) ...	1.8	25.9
Unsaponifiable (per cent) ...	0.8	0.9
Fatty Acids.		
Solidifying point (Titer value)	28.4°C	35°C
Mean Molecular weight ...	284.3	—
Iodine value (Wijs) ...	94.2	—

Uses of Oil.

Kapok oil is used to a certain extent, especially in Holland, for edible and soap-making purposes. It is not a well known oil however but as the oil can be used for the same purposes as Cottonseed oil and the cake likewise is a valuable feeding stuff, there is every reason to hope that with larger quantities of seed available and regular shipments coming forward the market for kapok oil will widen considerably.

Climate.

The equable character of the climate of Malaya simplifies the consideration of the problem of the advisability of planting kapok in any particular district. The fact that strongly growing trees may be found in almost any district throughout the Peninsula is sufficient evidence of the adaptability of this plant to local conditions. Kapok is a tropical crop and may be found in all countries at such altitudes as are free from frosts. Generally it may be stated that kapok is suited to the tropical lowlands, and in particular to situations sheltered from strong gales. Although the wood is very brittle and from that point of view the trees are liable to suffer from the effects of wind, yet the small resistance offered by its sparse leaf system and scanty branches, constitute a natural protection against wind. It is only when the tree becomes very large that there is likely to be serious danger from this cause. Serious injury to the crop owing to unusual climatic conditions is illustrated from the following extract(1) concerning the Java crop in 1920.

> "The 1920 crop in Java turned out a failure as regards quantity "and quality, owing to the abundant rains which fell in Septem- "ber and October. The crop is estimated at a third of the "normal one."

The harvesting season in Java is September and October, while in Malaya it is April and May. This fact is of distinct advantage to this country especially in the early stages of establishing the local industry, as of course the demand for kapok is keener, and consequently the prices higher between the Java seasons.

(1) Report on Commerce, Industry and Agriculture in the Netherlands East Indies during 1920.

Normally the kapok tree fruits in the dry season, and but once annually. In a climate such as Malaya, the fruiting season of kapok is apt to be more uncertain than is the case in countries with more definite seasons, and this variation of fruiting season may to affect adversely the quality of the floss unless special care is taken at harvesting time. In Java, the natives collect the kapok almost daily during the fruiting season, picking up the pods when they fall from the tree. In Malaya, the pods should be plucked from the tree as they ripen, for if the Java system is followed the rains and heavy dews may damage the floss to a serious extent.

Soil.

The kapok tree has a root system very similar to that of its branching, *i.e.* long roots running at right angles to the tap-root. It is therefore of great advantage to plant in friable soils. The finest kapok is produced in Java where it is grown in well-weathered volcanic soil. It is probably due to this fact that the best grade of Java kapok comes from the foothills of the Molriah Mountains of the Samarang Presidency. In the absence of such soil conditions, a good friable loam soil is most desirable. Such a soil will allow easy and active development of the root system. Soils of this description are not uncommonly met with in Malaya, especially along the banks of rivers and in ravines. Soils containing a large amount of humus are also suitable, provided that the drainage of such land is effective. It is observed, for instance, that the land in the Bagan Dato area of Lower Perak and at Jeram in Selangor, consisting of soil of this description produces quick-growing healthy trees.

Whereas it is important that drainage be effective, the occasional flooding of land on which kapok is growing is immaterial; in fact, the Malays on the Perak River assert that such floods are of benefit to the crop, and this statement is borne out by the fact that the kapok trees along the Perak River are the finest seen in the Federated Malay States, and are subject to these conditions,--the land being inundated for a few days in each year during the heavy rains. Laterite and heavy clay soils are to be avoided. Owing to the fact that white ants are attracted to kapok, the crop should not be grown on land newly felled and containing a large amount of timber.

Propagation.

Kapok may be grown either from stem or branch cuttings, or from seed. It is stated that in the Philippine Islands the tree is generally established from cuttings, as this is undoubtedly the easiest method of propagation. This would appear to be an insufficient reason for the adoption of a method, especially when, as in this case, the method carries with it decided objections. Trees grown from cuttings commence bearing about one reason ahead of trees grown from seed, but, on the other hand, they are more liable to the attacks of white ants; more apt to suffer in high wind owing to the absence of a tap root; and the normal life of such trees is found (locally) to be considerably less than is the case when the crop is grown from seed. It would appear therefore, that the disadvantages of this system out-weigh the advantages claimed for it.

If it is decided to propagate from cuttings, branch cuttings are the better. Cuttings from two to three year old branches, of about 2-3 inch diameter and 4-6 feet long should be employed. They should be planted out as soon as cut. Stem cuttings are frequently employed by Malays for the construction of fences. Such cuttings are generally about six inches or more in diameter and about six feet in length.

Cuttings should be planted during a rainy season, otherwise the number of supplies necessary may be very large.

The method of establishing the crop from seed is most strongly advocated. This may be effected either by prelimary propagation in a nursery, or by planting "seed-to-stake." In the former case nursery beds, raised about six inches, should be about 4 feet wide, and the seeds planted one foot apart. A light "atap" shade should be provided during the early stages of growth, such shade being reduced as the seedlings grow. The seedlings should be transplanted when they are from eight to ten months old. In lifting, care should be taken to prevent damage to the roots, especially the tap root. The crown is removed, leaving about four feet of stem which should be planted in the field with little delay. Transplanting should be effected, if possible, in rainy weather.

The rapid germination and growth of kapok renders the planting of this crop by the method of "seed-to-stake" a sound undertaking. Furthermore by this method the plants do not receive a check during development, and so are less liable to the attack of white ants. The expenses of establishing the crop by this method are less then when nurseries are employed, as directly the land is cleared, crops other than kapok may be interplanted.

In "seed-to-stake" cultivation, about three seeds should be placed in each hole on land previously lined for planting. At an early stage, say from two to three months from planting, all but one of the seedlings in each hole are to be carefully removed, disturbing the remaining plants as little as possible in the process.

The planting distance for kapok should be 18' × 18' or 20' × 20'. This will allow sufficient space for both root and branch systems. It is observed that with close planting, the branches refuse to overlap and are consequently smaller and produce less fruit. Planting at distances suggested above has the added advantages of permitting subsidiary crops to be cultivated between the rows; and implements to be employed at less expense and with less liability of injury to the main crop.

Little after-cultivation of kapok is necessary. If other crops are not grown in conjunction with kapok, a circular space of four feet should be kept clean around each plant during the early stages of growth.

If kapok cultivation is to be systematized in Malaya a definite schem e of planting, not only of the primary crop, but of other crops under the kapok must be formulated. It is doubtful whether kapok as a sole crop will ever come into favour, but there can be little doubt

that, grown as a main crop, in conjunction with various other crops, especially if the latter are fibre producing plants, kapok cultivation can be made a great asset to "mixed plantations." The cultivation of crops under kapok is made possible by reason of the few leaves and branches produced by kapok. The shade cast by the trees is therefore small, and for three months of the year nil, so that there is a wide range of plants amongst which a selection may be made. It is reported that in Java, coffee, cacao, pepper and vanilla are used in this connection. The Philippine Islands add to this list maguey (cantala), sisal, henequen and mauritius hemp. From observations made in this country, roselle fibre, sunn hemp, tuba, limes and tobacco should prove successful. The advantage of specialising on fibres as far as is practicable is that much of the machinery necessary for preparation of kapok can be adapted for other fibres. This applies more particularly to the preparation of the commodity for export. It is worthy of note that the Malays on the banks of the Perak River frequently plant limes with kapok as they have found by experience that similar conditions are favourable for the two crops. The most suitable crop may of course vary with local conditions, so that no more precise suggestions than the above can be offered in this place.

It is unlikely that kapok removes any large amount of manurial constituents from the soil, for the actual weight of crop removed from the land is small.

The after cultivation of kapok is not essential, but the plantation is sure to improve with cultivation, and possibly with manuring, and the desiderum can be most economically effected by means of subsidiary crops.

Age of Bearing.

Kapok comes into bearing in about three to four years. In the first year of bearing, about fifty pods per tree may be expected, with a very rapid increase in the yield in each subsequent year, until in about the eighth year the average yield may be 400-600 pods per tree. As no systematic planting of kapok has been undertaken in Malaya, an estimate only is possible based on careful observations on the yield and age of individual trees and small groves of trees. A fair average yield of kapok per tree in Lower Perak would be 100 pods per annum, but individual trees, growing in open spaces unhampered by coconut and durian trees have been noted to give over one thousand pods per tree. If this is possible under native conditions with trees of over thirty years old, similar results should be obtainable at a younger age with trees grown under careful plantation conditions.

The supplying of trees on a kapok plantation is possible at all ages of the plantation, as the seedlings will grow and thrive in the small shade cast by the older trees. This is an important point, because unlike a rubber estate, there need never be spaces left in the area through die-outs on account of white ants or other causes. It allows too, for the replanting of an area when the yield has fallen off through old age of the trees.

The maximum age of the kapok tree is uncertain, depending as it does, very largely on external circumstances. The writer has seen trees of 35-40 years old in full bearing, but at such an age the loss of trees through wind-break and die-back would possibly be large.

Pests and Diseases.

Hitherto, pests and diseases of kapok have caused little inconvenience in this country. This is due in part to the fact that the crop is not cultivated on a larger scale, and possibly because, having been considered an unimportant crop, little note has been made of any such danger. From observations made locally, and drawing largely on the experience of Java and the Philippines, the following notes are compiled to serve as a guide to the pests and diseases which may be causes of loss on kapok plantations.

Pests.

White ants are undoubtedly the most serious pest of kapok. The methods of control usually adopted on rubber estates are familiar to the majority of readers. Exhaustive literature exists and reference is directed to the following publications on this subject: F.M.S. Department of Agriculture, Special Bulletin Nos. 1 and 3. Prevention is better than cure, and it is recommended that the plantation shall be as free of timber as possible, to reduce the number of breeding places.

Dysdercus cingulatus, Fabr., a species similar to the cotton stainer (*D. Suturellus*) attacks the pods, but damage caused by this pest is said to be small.

Helopeltis attacks the pods. It is said to be kept in check by some parasite at present unknown.

Batocera hector and *Alcides leeuwenit*, Heller are mentioned as occasionally being the cause of considerable damage to young trees in Java. The former may be kept in check by hand picking and by stuffing the holes made by the insects with carbon bisulphide on cottonwool. No successful treatment of the latter pest has so far been reported. Monkeys and squirrels do considerable damage to trees in Malaya. The monkeys eat the growing shoots, while the squirrels open half-ripe pods to extract the seed.

Diseases.

Loranthus (*L. Pentandrum*, *L. schutesii* and *L. praelongus*), known to Malays under such names as Dalu api, api api, dalu gajah, are the principal plant-parasites of kapok. Kapok, on account of its deciduous leaves and sparse branching system is an ideal host for this pest which can only thrive with plenty of sunlight and air. The disease is spread by birds which eat the seeds. Seeds rapidly germinate and haustoria penetrate into the bast and wood of the host plant, whence the parasite draws all its nourishment. The damage may be great; the wood dies off owing to the fact that the food supply is cut off, and the whole tree is greatly weakened by the drain on its necessary nourishment.

Trees should be kept free from all parasites. Neglect only is responsible for the rapid spread of Loranthus. If the plantation is regularly inspected and the first signs of the disease removed by cutting, the control is effective.

Pink disease (*Corticium salmonicolor*) has been known to attack kapok. Leaf spot (Ramularia Eriodendri Rae) and an unidentified disease the symptoms of which are bleeding at the base of the trunk are reported as the occasional cause of damage in kapok plantations.

Harvestine.

The harvesting of kapok calls for no skilled labour and little expense. "Kapok is largely grown in Java by the natives who "collect the kapok down almost daily as the pods drop from the trees, "thus every few weeks a small quantity, varying from 2.5 to 50 lbs. is "accumulated.....the collecting is done by his children, so that all he has to do is to carry this accumulation to the village "stores". Abstract from "Memorandum respecting organization in Java for collecting and marketing kapok grown in native homesteads;" prepared by the British Commercial Agent for the Netherlands East Indies.

On the other hand, "The Literary Digest" for May 6th 1922 describes the harvesting of kapok in Java as follows:— "The "natives sally forth with great poles of bamboo with which they bring "down the long pods.....Agile Javanese climb "aloft into the branches".

The above are rather conflicting statements; the probability is that both methods are in vogue, the former at such times as the weather is exceptionally dry; the latter when the weather is unsettled, and the floss might be damaged through water.

In the careful harvesting and grading of the crop lies the possibility of establishing an industry in kapok. On ripening, the green pods containing floss and seed wither and become dark brown. The pod then opens from the top. In damp weather especially, the pod will persist on the tree in a half-open condition; and frequently too, while the pod persists, the kapok is liberated. In any case the kapok is either lost or damaged by rain. Discolouration through dampness originates in the first place from the seed, and secondly by reason of fungus or fermentation. Prevention of loss of crop from these causes can be attained by plucking the pods as they ripen. The harvester, provided with a bamboo, to the end of which is affixed a curved knife, plucks all pods which are turning or have become brown in colour. When the trees are old the worker cannot have sufficient command over the bamboo to harvest from the ground. He is therefore provided with a shorter bamboo and climbs the tree, from which point of vantage he commands a clear view of the pods, and can select those in a suitable condition for harvesting.

Immature pods produce a floss lacking the lustre of perfectly ripe kapok, and with less desirable characters; overripe pods produce floss of poor colour (often distinctly discoloured). Any unripe pods harvested should be spread out to dry in the sun, with further drying after

the husks are removed. It is strongly advised that kapok be kept in three grades, and sold as such viz. No. 1 quality (from ripe pods) No. 2 quality (from unripe pods), No. 3 quality-(damaged).

Kapok produces one crop per annum. At harvesting time the tree is without leaves, which much facilitates the work. The harvesting season varies slightly in different parts of the country. In general, it may be said to follow the season of greatest rain. In most districts harvesting commences about April. The pods do not ripen together, so that the season is carried through about three months.

Preparation prior to Ginning.

As soon as the pods are gathered and graded as described above, they should be placed on a cement floor in the sun to dry. Children may be employed in removing the outside husk and placentas, both of which are useless. A proportion of the seed can be shaken out at the same time, or this may be made a subsequent operation.

Ginning.

"It is essential that kapok be put on the market in a clean condition, that is, free from seed. Colour does not matter so much, but cleanliness is all-important. Kapok has replaced feathers to a large extent because of the difficulty in cleaning the latter." This is a statement by a broker of Mincing Lane. If kapok is to hold its own, and in particular, if Malayan kapok is to gain a name for itself in the world's market, care must be taken to ensure that the Kapok as exported is clean or, as the same authority goes on to say "if cleanlines could not be assured it is better to ship the stuff without description as simply "kapok" and it would be sold by sample. It would be better to do this than to declare it as cleaned and then for the purchaser to find it not really clean and demand an arbitration."

The consideration of ginning is therefore all important and so is discussed in this place in more detail than are other aspects of the production of kapok.

The separation of the seed from the floss is relatively easy, as the former do not adhere to the latter; kapok may therefore be cleaned by hand picking or by a simple hand machine, or by special kapok ginning machinery.

A simple machine may be constructed in the following manner. A barrel or tub, with the top removed and the bottom perforated, is provided with a vertical beam, fixed in a socket at the bottom and passing through a hole in a brace at the top of the tub. This vertical rod should be able to revolve with ease. The rod projects about two feet from the top of the barrel. From the rod, below the level of the top of the barrel, project at regular intervals at right angles to the rod, two rows of arms, placed opposite, and of such a length that they do not quite touch the sides of the barrel. From the sides of the barrel, projected inwards, are four rows of arms, placed opposite and in such a position that in revolving the beam the arms of the latter alternate with the arms of the barrel.

Round the upper part of the vertical rod is twisted once a length of rope of several yards in length. Two men are stationed on opposite

sides of the barrel, facing one another, and alternately pull the rope, while a third men feeds kapok previously freed of husk and placentas, into the barrel. Thus the kapok is caught between the rapidly revolving arms and the stationery arms, causing it to be opened up and freed of its seed, which falls through the perforations at the bottom of the barrel.

The Malays sometimes employ a rather similar method to the above. The kapok is placed in an open receptacle and a forked bamboo is caused to revolve in the kapok by chafing the stick between the palms of the hands.

Another simple method of freeing kapok of its seed is to place it on a wire frame placed about two feet from the ground and beating the floss with sticks The seed falls through the mesh and the floss is then removed. This method is apt to break up the floss thus lowering its value, and for this reason is not recommended.

The chief objections to these hand methods is that they are generally only effective under close supervision.

The following method described to the writer, of the method employed in treating kapok at a Chinese " fabrik " at Cheribon, Java is of interest. The owner in question stated that the machinery used was invented by his father many years ago, which goes to prove that a fine grade kapok can be prepared by primitive machinery. At this factory the kapok received with husk goes through the following four processes.

First Process.—The pods are picked by hand, one person so treating 2,000 pods por diem. 12,000-13,000 such pods go to the making of one pikul of clean floss. The husks are used as firing ; the placentas as a mattress filler, while the seed is crushed for oil. During this process the kapok is graded.

Second Process.—Sifting of the floss by hand for the extraction of seed. The pods are placed on a wire frame placed in a box and gently stirred with the hands. By this process 25% of the seed is extracted. A great point appears to be made of the fact that up to this point the fibre has not been dried.

Third Process.—The partly-seed-extracted floss from the second process, which is in a " lumpy " condition is placed on a concrete floor enclosed in wire netting. It is dried in this way by exposure to the sun for at least five hours. The presence of a gentle wind is of advantage. Workers turn the floss at intervals in order to expose a new surface to the sun's rays. During this pocess 15% of the seed is extracted.

Fourth Process.—Consists of fine cleaning and lump elimination. The fibre is placed in a revolving cylinder open at either end, and a current of air created by a fan driven through. In this way, the floss loosened from the mass by the revolving cylinder is blown through the further end of the cylinder into a perfectly clean room, where it settles, and later is removed and packed. The seeds and dust remain in the cylinder.

The cylinder in question is said to be about four feet in diameter and twelve feet long.

In this factory 95% of the floss produced is first class quality and 5% of second quality.

The following machinery is in use for the ginning of kapok :—

The Bley Machine invented by Mr. G. Bley, a prominent kapok planter of Java. The machine was exhibited and operated at the Surabaya Fibre Congress and Exhibition 1910 and obtained first prize. The machine is made by Messrs. Lindeteves Stockvis of Batavia and Samarang. It has a capacity of 3—3½ pikuls per hour if the kapok is sundried, and requires one horse power to drive the machine at a rate of 500/600 revolutions per minute. The price of the machine was quoted in August 1922 at fl. 980. The Bley machine is said to be one of the best on the market. The following are the particulars of this machine.

The Bley Machine consists of a horizontal, cylindrical, wooden drum, the bottom being of ½" mesh wire-netting, through which a square-section steel axle is fitted in self-lubricating bearings, with a number of vanes or beaters set spirally on each face of the axle. These beaters are fixed at an angle, like the blades of a propeller, and by imparting a screwing motion, draw the kapok through the machine. The last pair of beaters, near the outlet, are set in the opposite direction to avoid choking the outlet. Opposite the outlet are two large fan-like blades, set in the same plane as the axle. These create an air-blast, which expels the cleaned kapok.

Into the walls of the drum, between the beaters, iron pins are driven, and round-section pins may also be fitted on the axle opposite the beaters. The best number of such pins must be determined experimentally, as too many will cause the fibre to break, and the product will be poor and stringy.

Probably the axle, bearings and beaters could be obtained separately from the makers; the drum could easily be constructed on the spot.

This machine can be worked by hand, but owing to the irregularity of this method, power is necessary to produce the best quality kapok.

A detailed description, with drawings, may be found in "Kapok: Culture are Bereiding," published (in Dutch) by the Nederlandsch-Indisch Landbouw-Syndicaat, Soerabaia.

It is recommended that the machine be installed, where possible, in an upper storey. The seeds can be allowed to fall down a shoot to the lower floor, thus overcoming the risk of their mixing with the cleaned kapok. The power would also be installed below, so that the driving-belt is not in the way. It is a somewhat curious fact that although the publication of the Bureau of Agriculture, Manila: "The Kapok Industry" describes several machines for the cleaning of kapok, yet the Director of Agriculture for the Philippines in a recent letter states: "We have been unable to learn of the successful operation of any kapok machine operated for commercial purposes in the Philippines," and that no such machine is obtainable at present in that

country. On the other hand, machinery is commonly (although not exclusively) used for ginning kapok in the Dutch East Indies, and of such machines, the Director of the Division of Commerce, Buitenzorg particularly mentions the Bley machine. The machine has been in use on some Batavia Estates for many years, so it may be presumed that it is satisfactory.

Mr. Saleeby in The "Kapok Industry" gives particulars of the following two machines regarding which he has any information of importance.

"The Becker Machine invented by Messrs. Becker & Co. "Surabaya, Java. This machine works on the general principle of "the Bley machine, differing from the latter principally in having the "cleaning chamber set perpendicularly instead of horizontally as in "the Bley Machine, and in its operation and construction being per- "haps a little more complicated than the latter. It is claimed that "this machine cleans about 120 kilos of kapok floss per hour" It requires 3 horse power to drive.

For the Becker machine it is said that the kapok requires no preliminary drying before treatment in the ginner.

"The Lienau Machine.....is built on a very much smaller "scale than the latter and is not provided with a fan. It requires "from one-half to one horse power for its operation, and will clean "between 120 and 130 kilos per day of ten hours. Its simplicity of "construction, the inexpensiveness of its operation, and its low cost "would indicate that it can be operated to advantage on small planta- "tions."

Mr. E. Lehman, Engineer, Manchester, is the maker of a cotton ginner, the particulars of which are given in his catalogue (1922) as follows:—

"These machines are specially constructed to liberate the cotton from the seed, and are adopted for small or large plantations.

They will gin East and West Indian Cotton, China, Central and South American, East and West Africa, Pacific Island Cotton, and are also adapted for ginning Kapok or Java Silk Cotton.

They are also specially constructed for transport in hilly countries.

I make them in sizes from 12 inches wide to 49 inches wide.

The 12 inch machine is for Hand Power, and the other sizes Belt Power

The Hand Machine will produce about 21 lbs. of Clean Cotton per hour, according to class: a 43 inch machine, driven by Belt Power, will produce about 1,200 lbs. of Cleaned Cotton per day, the power required being very little, not more than 1 h.p."

"Prices and Particulars."

Cotton gin No.	Width.	Weight.	Space Occupied.	Price.
A	12 ins.	300 lbs.	1.06 by 0.9 mtrs.	£60
B	18 „	400 „	1.2 „ 0.9 „	£65
C	24 „	500 „	1.35 „ 0.9 „	£68
D	30 „	580 „	1.50 „ 0.9 „	&74
E	36 „	650 „	1.65 „ 0.9 „	£83
F	48 „	800 „	1.8 „ 0.9 „	£92

Bley also describes in "Kapok : Culture en Bereidung" two other machines.

The Gajamprit Machine.—This consists of a vertical drum and axle fitted with round, wrought-iron beaters, wrought-iron pins being also fixed in the wall, as in the Bley machine. An air-blast is provided by a fan at the bottom, which blows out the cleaned kapok through a wide pipe at the top. The heavy seeds fall through an opening at the bottom.

Hk. Jonker en Zoon's Machine.—This is a more complicated machine requiring 4 h.p. to drive at 400-600 r.p.m. About 600 kg. (about 9¾ piculs) per day of 10 hours is the capacity.

In consists of two separate drums, connected by a pipe. The first drum, which is horizontal, is steam-jacketed and the kapok passes, thence to the vertical drum.

The machine is made by Hk. Jonker en Zoon, V. N. Fabriek Amsterdam.

It would be suitable for dealing with large quantities, and produces a very fine and silky kapok.

Finally, it is recommended that a system of ginning be adopted which does not unduly break the floss. In the above account one hand arrangement has been shown to be suitable in this respect. The Bley Machine of all the machines discussed strikes one as the most reliable, having stood the test of long practical usage, and being inexpensive.

In connection with quality of floss the following standards have been decided upon by the "Handelsvereeniging" (Commerce Association), Samarang for kapok.

First Grade.—Known as "Superior Java" Containing less than .5% seed.

Second Grade.—Known as "Prime Japara" Containing not more than 2% of seed.

Third Grade.—Known as "Fair Average Java kapok" not more than 3½% of seed.

Buyers must accept delivery if seed content is not more than 1½% for "Superior Java", 5% for "Prime Japara" and 6% for "fair Average Java kapok."

It is stated that the quality demanded by America is that between the second and third grade, and by Australia, third grade or lower. From various enquiries it seems that Australia does not demand this poor quality but really requires good quality kapok.

Pressing and Baling.

In baling kapok for export it must be borne in mind that, on the one hand, excessive pressure will destroy the elasticity and quality of the fibre, while on the other hand, too small a pressure will result in heavy freight charges, —which are calculated on the volume of the rectangular bale. The exporters require that the pressure should be such that 2-2½ pikuls of floss would be contained in a bale of 36 cubic feet. Such a bale would require a pressure of about 140-150 lbs. per square inch, so that a bale of 3 feet × 3 feet (the height of the bale has no effect on the pressure required) would require a total pressure 181,440 lbs. (36 × 36 × 140); a bale of 2 feet × 2 feet a pressure of 80,640 lbs. (24 × 24 × 140). It is clear that a small bale requires a much less powerful press than does a large bale. Machine-cleaned or very dry fibre requires rather more pressure than does hand-cleaned floss. The following Report(1) indicates the material damage that may in occasioned by the over pressing of the bales.

"At the end of 1920, the Association of the Capoc Trade in "Amsterdam called the attention of the trade here to the fact that the "bales of capoc were being pressed to such an extent that the finest "quality suffered from it.

"The heavy pressure, a direct result of the high freight rates, "is done at the request of buyers, and exporters should therefore not "be held responsible for it."

Bley mentions the following dimensions of bale as satisfactory 28 inches × 26 inches × 24 inches, in height, weighing 90-100 lb., and points out that the bale should not be too heavy to be handled conveniently by one man.

Bales as received on the English market are pressed in sacking and bound with some sort of fibre. The bales are 2 ft. × 2 ft. × 5 ft 6 inches, weighing about 1¾ cwt.

Enquiry in Java on this question produced the following information: —"Kapok exported is hand pressed in bales packed in gunny "bags and bound with iron hoops; for European shipment in bales "weighing 1.60 pikuls (or 217 lbs); for Australian Shipment in "bales weighing 1.20 pikuls per double bale, and 0.80 pikuls per "single bale."

Henrie Jumelle in "Cultures Colonials-Planter-Textiles" says that kapok is baled in jute sacking for export to Australia, and in matting for Holland.

Information from Java is to the effect that hydraulic baling is necessary for export, while for inland convenience the kapok is pressed with the aid of handscrew presses made for kapok baling by several manufacturers in that country.

(1) Report on Commence, Industry and Agriculture in the Netherlands East Indies during 1920.

Bley describes the following types of press.

1. Bley Screw-press :—This consists of a four-sided chamber, extending from floor to ceiling, fitted with two screws, one above and below. The upper screw is worked by hand by coolies in the room above, the lower from a cellar or lower room. The final turns of the screw are given by means of a long lever.

2. Experienced coolies can turn out 30 bales in 12 hours.

2. Side-screw presses—These have two screws outside the press and can be driven either by hand or machinery; they are supplied by various English makers.

Messrs. Hollings and Guest, Ltd., Engineers, Thimble Mill Lane, Birmingham, are the makers of presses suitable for baling kapok. They state that they have sent out to Java numbers of presses for this purpose. After referring to the type usually supplied they state: "Any of the standard sizes are suitable, depending upon "the size and weight of bale required, though we may say that the "size generally supplied is the No. 1, with Box 2'0" × 3'0" × 6'0" in "depth." The price of this particular machine is marked at £250.

Hydraulic presses are the best for kapok if properly constructed. The pump must be driven by power; motor, petrol-engine, steam or water power. If power is not available, a screw-press should be used.

The pump should have an automatic link-motion to give low power at first, changing to high. The press must have a long stroke, at least three times the height of the pressed bale.

Packing.—Bales are generally packed in jute gunny bags or in Borneo matting. For small bales, such as are recommended, 4½ yards of 28 inch gunny bagging is necessary.

Bands.—Rotan has been much used in the past, but it is unsuitable as it is too small and sharp, and cuts into the bale. Iron bands are much better, but should be galvanised or varnished to protect the bale from rust. Bamboo has been found very satisfactory: it is light, strong and, of course, free from rust. Probably fibre bands are the most suitable.

Markets.

(a) *Local Markets.*

The main sources of supply for the local markets are Java and Sumatra. Locally grown kapok is rarely procurable except in small quantities. At the present time kapok from Java sells retail for from $50 to $60 per picul, while that from Sumatra is worth about $35—$40 per picul. The former supplies come from Samarang, Java, and are known as "Prime Samarang," while the latter is from Tapa Toen, Sumatra. About 500 piculs per annum are consumed by the local European shops, but this is but a small proportion of the total local consumption of imported kapok.

(b) *Export.*

At the present time Java produces 80% of the world's consumption of kapok. In this connection it is interesting to note that advice from Java states:—"Yet the industry there (in Java) is in a "very primitive stage and undeveloped." The statistics for 1920 shew the following kapok shipments from Java:—

Into United States of America	...	5,545 tons.
Into Australia	...	3,415 „
Into Holland and the rest of Europe	...	2,528 „

The imports of kapok into the United States have been as follows:—

1913	2,842 tons,	value.	$ 809,001 gold.
1918	9,576 „	„	2,820,474 „
1919	10,972 „	„	3,673,285 „
1920	9,881 „	„	3,847,610 „
1921	8,465 „	„	2,556,699 „

Many other countries export kapok in small quantities, the principal of which are the Philippine Islands, Ceylon, India and some of the countries of South America.

The kapok market is inviting increasing attention at present. The Times Trade Supplement of July 29th, 1922 under the title of "Ceylon Kapok Boom" stated:—"The demand for kapok has of late "become very strong. The first shipment of any considerable bulk "was forwarded from Colombo in April. At that time there was only "one shipper at Colombo, and he paid up to Rs. 50 per cwt. for "cleaned kapok of good quality. At the end of June there was a dozen "Colombo shippers ready to buy at Rs. 65 per cwt for fair quality "but sellers are holding out for Rs. 70. It is said that middleman "speculators are now booking forward crops at as much as Rs. 80 "per cwt."

Importers of Kapok into England, America and Australia have written to the Department of Agriculture, Federated Malay States and Straits Settlements and particulars of buyers' terms and requirements will be sent on application. In this connection the following general conditions of shipping are of value to intending shippers.

(America) Shippers guarantee that loss in weight from shipping to landed weights will not exceed 1%. If it does, the excess is to be debited back to shipper. Arbitration as to quality to be held in New York. Quality is principally decided on odour, excess of seed and length of staple. Price to be in Sterling per lb. c.i.f. New York. For this market standard of clean kapok is that containing not more than 4% of seed.

It cannot be too strongly urged that kapok destined for export is to be of good quality and free from seed. The produce from Malaya is unknown on the world's market, and if early consignments are of good quality advantage may be taken of the good prices ruling at the present time to introduce Malayan Kapok as equal to Prime Samarang grade.

The present month October 1922 wholesale prices of kapok are about one shilling to 1s./1d. for Prime Samarang to four pence per lb. for the very indifferent and mixed kapok exported from India.

Australia in 1919/20 imported 5,828,750 lbs. of kapok to the value of £319,542.

Sydney	...	25,000	bales (160 lbs. in a bale).
Melbourn	...	1,800	„ „ „
W. Australia	...	300	„ „ „
S. Australia	...	300	„ „ „

Yield.

For the purposes of estimates, based on observations made in this country, and from the experience of cultivators in Java and the Philippines, it may be accepted that the yield per tree of pods in a mature plantation is 100 pods. This is undoubtedly a safe estimate. One hundred pods produce 1 lb. of clean floss.

Mathieu's figures of actual weight of twenty pods taken from a heap at Kuala Kangsar in Perak are as follows :—husks 8 oz., floss 3 oz., placentas and peduncles 1.25 oz. ; total 18 oz.

The following figures obtained from various local sources indicate the variations possible :—

	T. Anson.	B. Gajah.	K. Kangsar.
Husks and Placentas ...	44	41	51
Floss ...	21	17.5	17
Seed ...	35	41.5	32

There are therefore about two pikuls of seed to one pikul of clean kapok.

Given 120 trees per acre the yield of floss would be about 400 to 500 lbs., and of seed 800-1000 lbs.

APPENDIX 1.

The Organization of the Kapok Industry.

The attention of the Department of Agriculture has been directed for some time towards the possibilities of organizing the local industry in Kapok, and it is proposed in this place to indicate the results of this investigation.

A rough census of kapok trees has been taken, with the results stated below :—

State.	No. trees.	Remarks.
Selangor ...	7,557	4,164 of which are in Kuala Selangor.
Negri Sembilan ...	3,887	Scattered.
Pahang about ...	5,000	,,
Perak ...	61,925	40,000 of which are near Perak River. 20,000 in Krian.
Malacca ...	7,000	Scattered.
Penang ...	6,100	4,000 of which are in Balik Pulau

or say 100,000 trees.

Thus if organization was perfect, the trees at present in existance are capable of producing annually at least 100 tons of clean floss, worth about $1000 per ton and 200 tons of seed.

Of the trees at present in bearing nearly three quarters are to be found in definite workable areas : viz., Perak River, Krian, Balik Pulau and Kuala Selangor. It is then, in these districts that endeavours will be made to educate the Malays to harvest their crops, and prepare the floss for market. Collecting centres will be established at which cash will be given for the kapok as brought in. In the past, the price given by Chinese buyers was so small as to offer no encouragement to the Malays to harvest their crops, except for their personal use, or to reduce the amount of their debts to the local Chinese shop-keeper.

It is not the intention of the Government to become traders in kapok. The organization of the industry will depend on the enterprize of unofficials ; but the Government will assist by using their influence with the Malays to induce them to harvest, and to use the correct method.

In the districts containing a large number of trees, arrangements have already been made for the purchase and preparation of kapok under European management.

Finally, the question will be asked : "Will it pay to plant kapok on a large scale ?" The answer to this question depends on the conditions of planting. It is of course impossible to forsee the condition of the market in four years time, but from present indications it seems that there is considerable scope for a larger area to be cultivated with this crop. The opinion of this Department is that kapok will undoubtedly pay when cultivated on mixed plantations, as the cost of production is low. Mathieu has estimated that the cost of harvesting and cleaning would not be more than 12 cents per lb ; and freight etc., to London 2.5 cents per lb. or say 14.5 cents per lb. from harvesting to London. The land being utilized for other crops in addition to kapok, the cost of cultivation can be divided between the crops occupying the ground.

APPENDIX 2.

Importers of Kapok.

England.

H. J. Lederer, 23/24 Farm Street, London, E.C.I.
A. Wallis, 10-11 Lawrence Lane, London. E.C.

America.

F. R. Henderson & Co., Inc. New York.
The Robinson-Roders Co., Inc. Sourabaya, Java.
H. E. Smith, 112 Market Street, San Francisco, Calif.

New South Wales.

R. A. Andrews, Davis and Raper Streets, Surrey Hills.
Bateman, Sydney.
E. W. Beard & Co.. 49 Paramatta Road, Gelebe.

New South Wales—*contd.*

E. Bentley & Sons, Fitzory Street, Marrickville (Importers of Cordage).
Bowan Bros. & Co., Ltd., Sydney.
Bruton & Wheeler, 307 Sussex Street, Sydney.
J. H. Buttler & Co., Ltd., Sydney.
A. Forsyth & Co., Ltd., 339 Kent Street, Sydney (Importers of Cordage).
Goodearls Ltd., 406 Kent Street, Sydney.
Grimley Ltd., Sydney.
Hooker, Chapman & Co., 188 Sussex Street, Sydney.
Nettleton Son & Co., 537 Kent Street, Sydney.
Pacific Commercial Co., Sydney.
A. H. Philips & Co., Sydney.
H. H. Sanders, Grafton.
Suzuki & Co., (Masuda Trading Co., Ltd.), Sydney.
S. Walder Ltd., Sydney.
C. E. Waters & Co., Ltd.. Sydney.

Queensland.

C. B. Barstow & Co., Charlotte Street, Brisbane.
Brabant & Co., Charlotte Street Brisbane.
Burns Philp & Co., Ltd., May Street, Brisbane.
Carricks Ltd., Saul Street, Brisbane.
Forsyth & Co., Ltd., Lytton Road, East Brisbane (Fibres).
J. W. H. Grant Ltd., Queen Street, Brisbane.
Gunnerson, Crockett Ltd., (Queensland) Bowen Street, Brisbane
King & King, Ltd., Queen Street, Brisbane.
Koonoomea Co., Merivale Street, South, Brisbane.
Laycook, Littledike & Co., Ltd., Herschell Street, Brisbane.
McWhisters Ltd., Valley Street, Brisbane.
Rosenstengels, Ltd., Ruthven Street, Toowoomba.
Shamblers Ltd., Gympie.
C. H. Slate & Co., Eagle Street, Brisbane.
Leonard Spencer, Brisbane.
Stuparts Ltd., Keat Street, Maryborough.
Geo. Wills & Co., Ltd., Wharf Street, Brisbane.

SOUTH AUSTRALIA.

J. W. Gresby & Co., Adelaide.
Prevost, Selth & Co., Adelaide.

VICTORIA.

Alfred Harvey & Co., Melbourne.
Branchaw & Allen, Melbourne.
Collins & Co., Pty. Ltd., Melbourne.
T. W. Cotton Pty. Ltd., Melbourne.
Eastern Imports Pty. Ltd.. Melbourne.
Geo. P. Harris, Scarfe & Co., Ltd., Melbourne.
The Mutual Store Ltd., Melbourne.
Prithard Bros, Readings.
A. Victor Legge & Co., Melbourne.

WESTERN AUSTRALIA.

Boan Bros., Perth.
McCorkill & Co., Perth.
Foy & Gibson, Perth.
C. & H. Locke, Fremantle.
Bon Marche, Perth.
A. Povey, Wellington Street, Perth.
Brown & Dureau Ltd., Wellington.
Cardale & Scott, P. O. Box 985, Wellington.
A. Clarke & Sons, 41 Elliott Street, Auckland.
Joseph Clarke & Co., Wellington.
Clarke & Co., Pty. Ltd., Wellington.
Dalgety & Co., Ltd., Featherstone St. Wellington.
Direct Importing Coy., of N. 2. Ltd., Panama Street, Wellington.
Ellison & Duncan Ltd., Napier.
Harrisons Ramsey Pty. Ltd. P.O. Box 1533, Wellington.
Henry Olsen & Co. Pty. Ltd., Wellington.
B. L. Hart & Co., Ltd., 92 Tory Street, Wellington.
Arthur E. Kewin & Co., Wellington.
Kirkcaldie & Strains Ltd., Wellington.
Macky, Logan, Cardwell Ltd., Elliott Street, Auckland.
David McCrae Ltd., Wellington.
Sargood Son & Ewen Ltd., 96 High Street, Dwindin.
Speedings Ltd., P.O. Box 462, Fort Street, Auckland.

APPENDIX 3.

Costs and Income of 500 acres of Kapok, (1911).

The following figures are based on those given by McGillvray in "Kapok; Rentabiliteit" published in 1911, by the Nederlandsch-Indisch Landbouro Syndicaat, for the cultivation of kapok only in Java. The price of the clean floss has since risen from $18.50 per pikul to about $50 per pikul, while the cost of production has also increased, but certainly not to a proportional extent.

Expenses.	$	$	Income.	$	$
Preparation.					
1st 250 acres, clearing roads, Quitrent, wages etc.		7770			
1st Year.					
Planting 250 acres and cleaning round trees.	370				
Preparing 2nd 250 acres.	2440				
Quitrent, wages and various.	4250	7060			
2nd Year.					
Upkeep 250 acres and green measuring.	530				
Planting 2nd 250 acres.	370				
Quitrent and wages.	4040	4940			
3rd Year.			*3rd Year.*		
Upkeep 500 acres.	1060		Kapok from 250	1427	
Quitrent and wages	3870		acres at $18.50 per		
Factory ane various	3900		pikul less $3.70 har-		
		8830	vesting, preparation and transport:— $14.30 per pikul.		
			Seed at $1.48 per pikul.	318	1745
4th Year.			*4th Year.*		
Upkeep, wages factory and bags.		8830	Kapok from 1st and 2nd planting.	5240	
			Seed „ „	1165	
5th Year.			*5th Year.*		6405
Upkeep, wages etc.		6360	Kapok ...	9525	
			Seed ...	2119	
6th Year.			*6th Year.*		11644
Upkeep, wages etc.		6360	Kapok and Seed.		13979
Total ...		50157	Total ...		33773

It is evident from the above that where other crops are grown in conjunction with kapok, the plantation reaches a paying stage at a much earlier date.